"Unconstrained" Facility Requirements

In this chapter, existing components of the airport are evaluated so that the capacities of the overall system are identified. Once identified, the existing capacity is compared to the forecast activity levels prepared in Chapter Two to determine where deficiencies currently exist or may be expected to materialize in the future. Once deficiencies in a component are identified, a more specific determination of the approximate sizing and timing of the new facilities can be made.

As indicated earlier, airport facilities include both airfield and landside components. Airfield facilities include those facilities that are related to the arrival, departure, and ground movement of aircraft. The components include:

- Runways
- Taxiways
- Navigational Approach Aids
- Airfield Lighting, Marking, and Signage

Landside facilities are needed for the interface between air and ground transportation modes. This includes components for general aviation needs such as:

- General Aviation Terminal
- Aircraft Hangars
- Aircraft Parking Aprons
- Auto Parking and Access
- Airport Support Facilities

The objective of this effort is to identify, in general terms, the adequacy of the existing airport facilities and outline what new facilities may be needed and when they may be needed to ac-

commodate the "unconstrained" forecast demands. Having established these "unconstrained" facility requirements, alternatives for providing these facilities will be evaluated in Chapter Four to determine the most practical, cost-effective, and efficient direction for future development.

PLANNING HORIZONS

Cost-effective, safe, efficient, and orderly development of an airport should rely more on actual demand at an airport than a time-based forecast figure. Thus, in order to develop a master plan that is demand-based rather than time-based, a series of planning horizon milestones have been established that take into consideration the reasonable range of aviation demand projections.

It is important to consider that over time, the actual activity at the airport may be higher or lower than what the annualized forecast portrays. By planning according to activity milestones, the resulting plan can accommodate unexpected shifts or changes in the aviation demand. It is important to plan for these milestones so that airport officials can respond to unexpected changes in a timely fashion. As a result, these milestones provide flexibility and potentially extend this plan's useful life should aviation trends slow over the 20-year planning period.

The most important reason for utilizing milestones is to allow the airport to develop facilities according to need generated by actual demand levels. The demand-based schedule provides flexibility in development, as the schedule can be slowed or expedited according to actual demand at any given time over the planning period. The resulting plan provides airport officials with a financially-responsible and needs-based program. **Table 3A** presents the planning horizon milestones for each activity demand category.

TABLE 3A
Aviation Demand Planning Horizons
Phoenix Deer Valley Airport

	2004	Short Term (± 5)	Intermediate Term (± 10)	Long Term (± 20)
ANNUAL OPERATIONS				
General Aviation				
Itinerant	137,550	180,000	200,000	240,000
Local	198,759	255,000	295,000	375,000
Air Taxi	4,079	6,400	8,400	12,400
Military	49	600	600	600
TOTAL OPERATIONS	340,437	442,000	504,000	628,000
BASED AIRCRAFT	1,270	1,524	1,748	2,185
ADJUSTED ANNUAL OPERATIONS				
General Aviation				
Itinerant	142,020	185,800	206,500	247,800
Local	205,219	263,300	304,600	387,200
Air Taxi	4,212	6,600	8,700	12,800
Military	49	600	600	600
TOTAL ADJUSTED OPERATIONS	351,500	456,300	520,400	648,400

Note: Aircraft operations have been adjusted to account for those that occur when the ATCT is closed (9:00 p.m. – 6:00a.m.).

The Phoenix Deer Valley (DVT) air traffic control tower (ATCT) is not a 24-hour tower, so the count is not all-inclusive of operations at the airport. Certain elements of the planning analyses, however, require that all the airport activity be considered. For these evaluations, it is necessary to estimate and adjust for operations that occur when the tower is closed.

The Phoenix Deer Valley ATCT hours are from 6:00 a.m. to 9:00 p.m. The operations were adjusted based upon the surveys discussed in the previous chapter and are included in the table.

PEAKING CHARACTERISTICS

Airport capacity and facility needs analyses typically relate to the levels of activity during a peak or design period. The periods used in developing the capacity analyses and facility requirements in this study are as follows:

- **Peak Month** - The calendar month when peak volumes of aircraft operations occur.
- **Design Day** - The average day in the peak month. This indicator is easily derived by dividing the peak month operations by the number of days in a month.
- **Busy Day** - The busy day of a typical week in the peak month. This descriptor is used primarily to determine general aviation transient ramp space requirements.
- **Design Hour** - The peak hour within the design day.

It is important to note that only the peak month is an absolute peak within a given year. All other peak periods will be exceeded at various times during the year. However, they do represent reasonable planning standards that can be applied without overbuilding or being too restrictive.

The following sections look at peaking factors for itinerant operations as well as total operations. Itinerant operations peaks assist in defining apron and terminal needs. Total operations peaks are used in analyzing airfield capacity as well as fuel storage requirements.

Itinerant Operations Peak Periods

Over the past fifteen years, the peak month for itinerant operations at DVT has occurred during the winter months of October through March. March was the peak month seven times over that period. Over that same fifteen-year period, the peak month averaged 9.7 percent of the annual itinerant general aviation operations.

Daily operational counts from the ATCT were utilized to determine a busy day peaking factor for itinerant general aviation activity. During the peak month over the past two years, the peak day of each week averaged 17.8 percent of the week. This equates to a busy day which is 23.4 percent higher than the average design day.

The design hour for itinerant operations was calculated as 11.7 percent of the design day operations, but this percentage can be expected to decline slightly as activity increases over the long term. **Table 3B** summarizes the general aviation peak activity projections for each planning horizon.

TABLE 3B
Peaking Characteristics
Phoenix Deer Valley Airport

	2004	Short Term (± 5)	Intermediate Term (± 10)	Long Term (± 20)
OPERATIONS				
GENERAL AVIATION ITINERANT				
Annual	142,020	185,800	206,500	247,800
Peak Month	13,800	18,000	20,000	24,000
Design Day	444	582	646	775
Busy Day	548	718	797	956
Design Hour	52	66	72	84
TOTAL AIRPORT				
Annual	351,500	456,300	520,400	648,400
Peak Month	34,100	44,300	50,500	62,900
Design Day	1,100	1,430	1,630	2,030
Design Hour	124	156	174	209

Total Operations Peak Periods

The peaking characteristics of the overall operations are utilized in examining the operational capacity of the airfield. The peak month for total operations has also averaged 9.7 percent over the last 15 years. Over that time, the peak month occurred during the winter months of October through March. March was the peak month five times over that period.

Design hour operations were calculated as 11.7 percent of the design day. This can be expected to decline as activity increases. **Table 3B** also summarizes the peak activity projections for the total operations planning horizons.

AIRFIELD CAPACITY

Airfield capacity is measured in a variety of different ways. The **hourly capacity** of a runway measures the maximum number of aircraft that can take place in an hour. The **annual service volume (ASV)** is an annual level of service that may be used to define airfield capacity needs. **Aircraft delay** is the total delay incurred by aircraft using the airfield during a given timeframe. FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*, provides a methodology for examining the operational capacity of an airfield for planning purposes. This analysis takes into account specific factors about the airfield. These various factors are depicted in **Exhibit 3A**. The following describes the input factors as they relate to Phoenix Deer Valley Airport:

- **Runway Configuration** - A parallel runway system with full-length parallel taxiways. The runways have a centerline separation of 700 feet. The primary runway has straight-in instrument approaches from both directions. At 8,208 feet in length, it can handle all the types of aircraft that use the airport. The parallel runway has no instrument approaches and is 4,500 feet long, so it is limited primarily to propeller aircraft.

- **Runway Use** - Runway use in capacity conditions will be controlled by wind and/or airspace conditions. Winds are considered calm below three miles per hour (mph). According to wind data from the National Climatic Data Center, the airport is under calm wind conditions 29 percent of the time. Winds favor Runway 7 (east flow) approximately 38 percent of the time, and Runway 25 (west flow) approximately 33 percent of the time.

- **Exit Taxiways** - Based upon aircraft mix, only taxiways between 2,000 feet and 4,000 feet count in the exit rating. There are two exits available within this range for Runways 7R and 25L. Runways 7L and 25R each have just one exit within this range.

- **Weather Conditions** - The airport operates under visual meteorological conditions (VMC) over 99.5 percent of the time. Instrument meteorological conditions (IMC) occur when cloud ceilings are between 500 and 1,000 feet. Poor visibility conditions (PVC) apply for minimums below 500 feet and one mile. Because IMC and PVC occur less than one percent combined, they are considered negligible for this analysis.

- **Aircraft Mix** – A description of the classifications and the percentage mix for each planning horizon is presented in **Table 3C**.

TABLE 3C
Aircraft Operational Mix - Capacity Analysis
Phoenix Deer Valley Airport

Aircraft Classification	Current	Short Term (± 5)	Intermediate Term (± 10)	Long Term (± 20)
VFR				
Classes A & B	98.9%	98.4%	97.6%	96.5%
Class C	1.1%	1.6%	2.4%	3.5%
Class D	0%	0%	0%	0%
Touch-and-Go's	46%	46%	47%	48%

Definitions:
- Class A: Small single-engine aircraft with gross weight of 12,500 pounds or less.
- Class B: Small twin-engine aircraft with gross weight of 12,500 pounds or less.
- Class C: Large aircraft with gross weights over 12,500 pounds up to 300,000 pounds.
- Class D: Large aircraft with gross weights over 300,000 pounds.

04MP01-3A-8/12/05

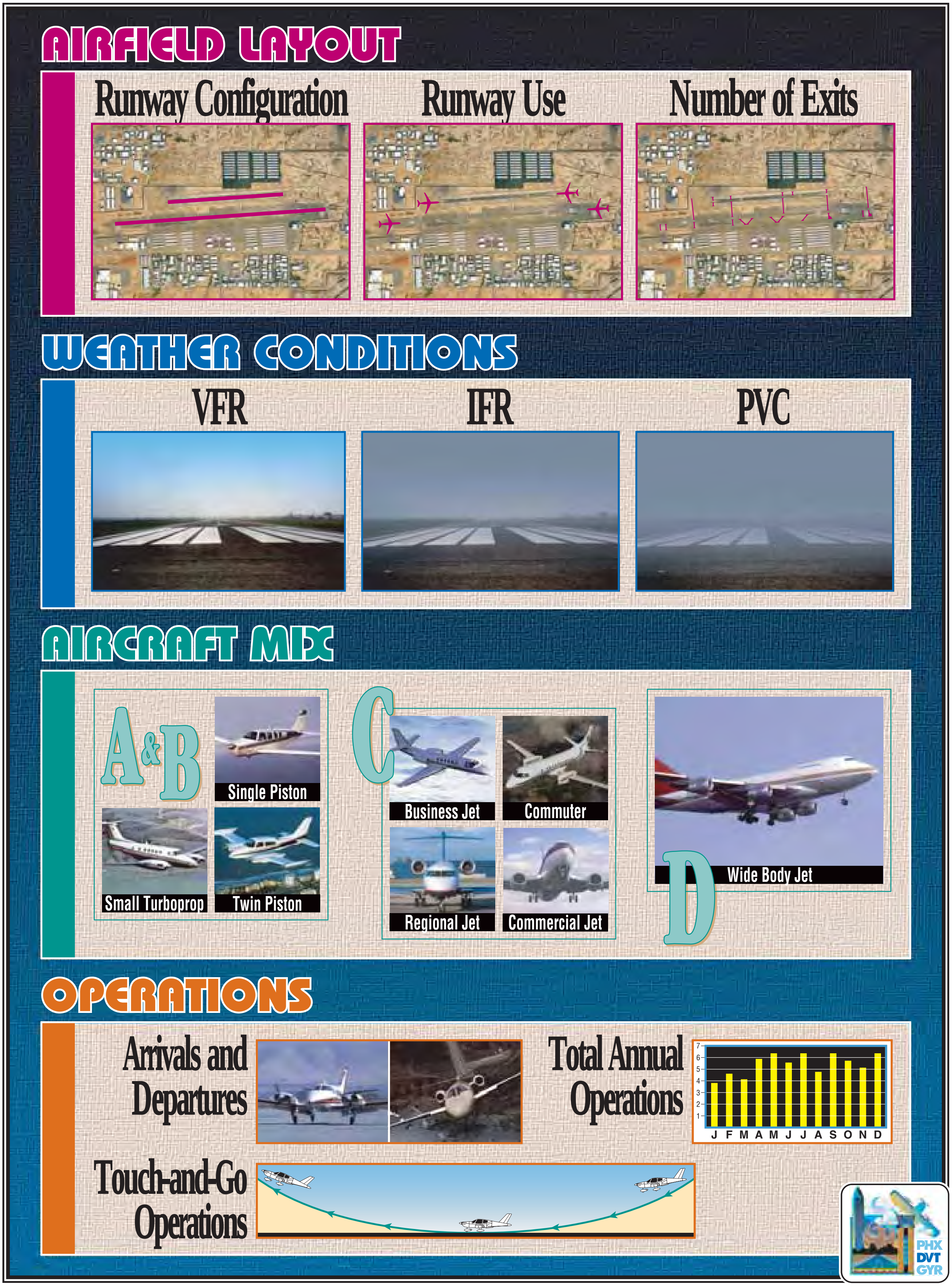


Exhibit 3A
AIRFIELD CAPACITY FACTORS

- **Percent Arrivals -** Generally follows the typical 50-50 percent split.

- **Touch-and-Go Activity -** Percentages of touch-and-go activity are presented in **Table 3C**.

- **Operational Levels -** Operational planning horizons were outlined in the previous section of this chapter. The peak month averages 9.7 percent of the year. The peak hour currently averages 11.7 percent of the operations in a day and is forecast to decline to 10.3 percent as operations increase over the long term.

HOURLY RUNWAY CAPACITY

Based upon the input factors, current and future hourly capacities at Phoenix Deer Valley Airport were determined. As the mix of aircraft operating at an airport changes to include a higher percentage of large aircraft (weighing over 12,500 pounds), the hourly capacity of the system declines slightly. As indicated in **Table 3C**, the percentages of Class C aircraft will increase with the planning horizon activity milestones. This results in a slight decline in the hourly capacity.

The current and future hourly capacities are depicted in **Table 3D**. At Phoenix Deer Valley Airport, the current hourly capacity is 228 operations. This is expected to decline to 227 operations in the long term. This is still above the design hour of 209 operations expected in the long term.

TABLE 3D
Airfield Demand/Capacity Summary
Phoenix Deer Valley Airport

	PLANNING HORIZON			
	Base Year (2004)	Short Term (± 5)	Intermediate Term (± 10)	Long Term (± 20)
Operational Demand				
Annual (Adjusted)	351,500	456,300	520,400	648,400
Design Hour	124	156	174	209
Capacity				
Annual Service Volume	645,000	661,000	681,000	703,000
Hourly Capacity	228	226	228	227
Delay				
Per Operation (Minutes)	0.40	0.65	0.83	1.51
Total Annual (Hours)	2,300	4,900	7,200	16,300

ANNUAL SERVICE VOLUME

The weighted hourly capacity is utilized to determine the annual service volume in the following equation:

$$ASV = C \times D \times H$$

C = weighted hourly capacity;
D = ratio of annual demand to the average daily demand during the peak month; and
H = ratio of average daily demand to the design hour demand during the peak month.

The ratio of annual demand to average daily demand (D) was determined to be 319 for Phoenix Deer Valley Airport. This is expected to remain relatively constant over the long range planning period. The ratio of average daily demand to average peak hour demand (H) was determined to be 8.87. This ratio was projected to increase to 9.71 by the long term planning horizon.

The current ASV was determined to be 645,000 operations. As peaks spread slightly with increased operations, the ASV will tend to increase, resulting in an annual service volume of 703,000 by the long term planning horizon. With adjusted operations in 2004 totaling 351,500, the airport is currently at 55 percent of its annual service volume. Long range adjusted annual operations are forecast to reach nearly 648,400 operations, which would be 92 percent of the airport's ASV. **Table 3D** summarizes the airport's ASV over the long range planning horizon.

AIRCRAFT DELAY

As the number of annual aircraft operations approaches the airfield's capacity, increasing amounts of delay to aircraft operations begin to occur. Delays occur to arriving and departing aircraft in all weather conditions. Arriving aircraft delays result in aircraft holding outside the airport traffic area. Departing aircraft delays generally result in aircraft holding at the runway end until released by air traffic control.

Table 3D summarizes the aircraft delay analysis conducted for Phoenix Deer Valley Airport. Current annual delay is estimated at 2,300 hours. As an airport's operations increase toward the annual service volume, delay increases exponentially. Analysis of delay factors for the long range planning horizon indicates that annual delays can be expected to reach 16,300 hours.

CAPACITY ANALYSIS CONCLUSIONS

Exhibit 3B compares annual service volume to existing and forecast operational levels at Phoenix Deer Valley Airport. The current operations level represents 55 percent of the airfield's annual service volume. By the end of the planning period, total annual operations are expected to represent 92 percent of annual service volume.

FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated*

04MP01-3B-8/12/05

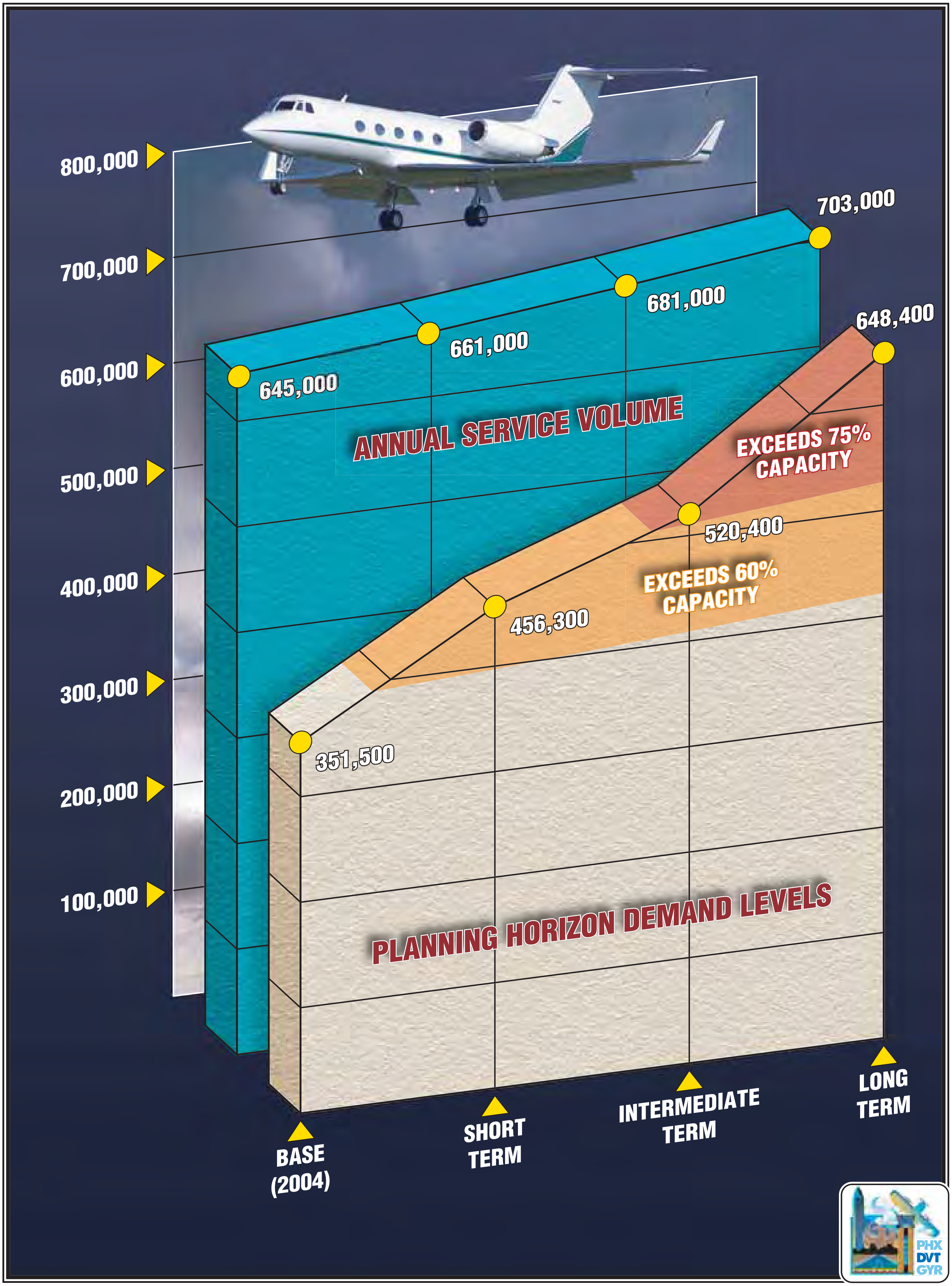


Exhibit 3B
AIRFIELD DEMAND VS. CAPACITY

Airport Systems (*NPIAS*), indicates that improvements for airfield capacity purposes should begin to be considered once operations reach 60 to 75 percent of the annual service volume. This range will be reached by the short term planning horizon and exceeded by the intermediate planning horizon. Examples of capacity improvements include, but are not limited to, additional taxiway exits, a longer parallel runway, and another parallel runway. These possibilities will be considered and evaluated in the alternatives analyses of the next chapter.

CRITICAL AIRCRAFT

The selection of appropriate FAA design standards for the development and location of airport facilities is based primarily upon the characteristics of the aircraft which are currently using, or are expected to use, the airport. The critical design aircraft is defined as the most demanding category of aircraft, or family of aircraft, which conducts at least 500 itinerant operations per year at the airport. Planning for future aircraft use is of particular importance since design standards are used to plan separation distances between facilities. These future standards must be considered now to ensure that short term development does not preclude the long range potential needs of the airport.

The FAA has established a coding system to relate airport design criteria to the operational and physical characteristics of aircraft expected to use the airport. This airport reference code (ARC) has two components: the first component, depicted by a letter, is the aircraft approach category and relates to aircraft approach speed (operational characteristic); the second component, depicted by a Roman numeral, is the airplane design group and relates to aircraft wingspan (physical characteristic). Generally, aircraft approach speed applies to runways and runway-related facilities, while airplane wingspan primarily relates to separation criteria involving taxiways, taxilanes, and landside facilities.

According to FAA Advisory Circular (AC) 150/5300-13, *Airport Design*, an aircraft's approach category is based upon 1.3 times its stall speed in landing configuration at that aircraft's maximum certificated weight. The five approach categories used in airport planning are as follows:

Category A: Speed less than 91 knots.

Category B: Speed 91 knots or more, but less than 121 knots.

Category C: Speed 121 knots or more, but less than 141 knots.

Category D: Speed 141 knots or more, but less than 166 knots.

Category E: Speed greater than 166 knots.

The airplane design group (ADG) is based upon the aircraft's wingspan. The six ADGs used in airport planning are as follows:

Group I: Up to but not including 49 feet.

Group II: 49 feet up to but not including 79 feet.

Group III: 79 feet up to but not including 118 feet.

Group IV: 118 feet up to but not including 171 feet.

Group V: 171 feet up to but not including 214 feet.

Group VI: 214 feet or greater.

Exhibit 3C summarizes representative aircraft by ARC. According to the previously approved airport layout plan, Phoenix Deer Valley Airport has been designed and planned for ARC D-II.

In order to determine several airfield design requirements, the critical aircraft and critical ARC should first be determined. Appropriate airport design criteria can then be applied. This begins with a review of the type of aircraft using and expected to use Phoenix Deer Valley Airport. **Table 3E** provides a projected breakdown of planning horizon operations by airport reference code.

TABLE 3E
Airport Reference Code (ARC) Mix
Phoenix Deer Valley Airport

		ANNUAL OPERATIONS		
Reference Code	**2004**	**Short Term (± 5)**	**Intermediate Term (± 10)**	**Long Term (± 20)**
A, B-I	319,368	412,150	466,500	574,100
A, B-II	29,690	39,500	45,600	62,000
C-I	1,162	1,900	2,860	4,900
C-II	834	1,340	2,070	3,600
C-III	6	310	420	750
D-I	108	260	480	600
D-II	280	630	1,050	1,700
D-III	52	210	420	750
Total	351,500	456,300	519,400	648,400

Note: Operations based upon adjusted ATCT count.

A review of the table indicates that aircraft in ARC C-II accounted for over 800 operations in 2004. As the most demanding family of aircraft with over 500 annual operations, ARC C-II is the current critical design ARC.

It is evident from the table that aircraft in more demanding ARCs use the airport, just not enough to currently qualify as the critical ARC. Since approach categories C and D are essentially comprised of jet aircraft, the forecasts for growth of business jets demand and production will result in increased business jet use. As indicated in Chapter Two-Forecasts, Phoenix Deer Valley Airport can ex-

04MP01-3C-9/1/05

A-I

- Beech Baron 55
- **Beech Bonanza**
- Cessna 150
- Cessna 172
- Piper Archer
- Piper Seneca

C-I, D-I

- Beech 400
- **Lear** 25, 31, **35**, 45, 55, 60
- Israeli Westwind
- HS 125-400, 700

B-I less than 12,500 lbs.

- Beech Baron 58
- Beech King Air 100
- Cessna 402
- **Cessna 421**
- Piper Navajo
- Piper Cheyenne
- Swearingen Metroliner
- Cessna Citation I

C-II, D-II

- Cessna Citation X
- **Gulfstream** II, III, **IV**
- Canadair 600
- Canadair Regional Jet
- Embraer Regional Jet
- Lockheed JetStar
- Super King Air 350

B-II less than 12,500 lbs.

- **Super King Air 200**
- Cessna 441
- DHC Twin Otter

C-III, D-III

- Boeing Business Jet
- B 727-200
- **B 737-300 Series**
- MD-80, DC-9
- Fokker 70, 100
- A319, A320
- Gulfstream V
- Global Express

B-I, II over 12,500 lbs.

- Super King Air 300
- Beech 1900
- Jetstream 31
- Falcon 10, 20, 50
- Falcon 200, 900
- **Citation** II, **III**, IV, V
- Saab 340
- Embraer 120

C-IV, D-IV

- **B-757**
- B-767
- DC-8-70
- DC-10
- MD-11
- L1011

A-III, B-III

- DHC Dash 7
- **DHC Dash 8**
- DC-3
- Convair 580
- Fairchild F-27
- ATR 72
- ATP

D-V

- **B-747** Series
- B-777

Note: Aircraft pictured is identified in bold type.

Exhibit 3C
AIRPORT REFERENCE CODES

pect more business jet activity. **Table 3E** further reflects this potential.

The most demanding aircraft using the airport are the Bombardier Global Express (C-III) and the Gulfstream V (D-III). The Global Express has a 99.4-foot wingspan, and the Gulfstream V has a 96.4-foot wingspan. Based upon the data, these aircraft accounted for 58 annual operations in 2004. In the future, the C-III and D-III ARCs both are forecast to exceed 500 annual operations.

To consider this future potential, the airfield capability of DVT will need to be examined. Of the five airports serving business jet traffic in the northern and western Phoenix metropolitan area, only Sky Harbor International Airport and Phoenix Goodyear Airport are currently designed for the ARC and pavement strength of the C-III and D-III aircraft.

Like Phoenix Deer Valley Airport, Scottsdale Airport has experienced some operations by ADG III aircraft. Scottsdale Airport's pavements are strength-rated at 75,000 pounds dual-wheel loading (DWL). The Global Express and the Gulfstream V can weigh up to 98,000 pounds DWL. In addition, the runway and taxiway clearances at Scottsdale Airport are not designed for ADG III aircraft. As a result, these aircraft must be granted prior approval to land. The constraints surrounding Scottsdale Airport make upgrading the airport to fully accommodate ADG III aircraft unlikely. Similarly, constraints around the Glendale Municipal Airport make it an unlikely candidate to serve ADG III aircraft on a regular basis.

This leaves DVT positioned to serve the future ADG III business jet demand in the North Valley, provided the airport can adapt to the appropriate design standards. **The following chapter (Airport Development Alternatives) will examine the potential for DVT to accommodate ARC D-III aircraft as the critical aircraft.**

AIRFIELD REQUIREMENTS

The analyses of the operational capacity and the critical design aircraft are used to determine airfield needs. This includes runway configuration, dimensional standards, pavement strength, as well as navigational aids and lighting.

RUNWAY CONFIGURATION

Key considerations in the runway configuration of an airport involve the orientation for wind coverage and the operational capacity of the runway system. The airfield capacity analysis indicated that additional airfield capacity will need to be considered by the intermediate planning horizon. As a result, the Master Plan should consider capacity improvements when activity approaches the operational capacity of the airfield. This will be a factor considered during the formulation and evaluation of alternatives.

FAA Advisory Circular 150/5300-13, Change 8, *Airport Design*, recommends that a crosswind runway should be made available when the primary runway orientation provides less than 95 percent wind coverage for any aircraft forecast to use the airport on a regular basis. The 95 percent wind coverage is computed on the basis of the crosswind component not exceeding 10.5 knots (12 mph) for ARC A-I and B-I; 13 knots (15 mph) for ARC A-II and B-II; 16 knots (18 mph) for ARC A-III, B-III, and C-I through D-II; and 20 knots (23 mph) for ARC C-III through D-IV.

The most recent 10 years of wind data specific to the Phoenix Deer Valley Airport at the time of this analysis was 1994-2003. This data is graphically depicted on the wind rose in **Exhibit 3D**. The orientation of both Runways 7R-25L and 7L-25R provide 98.54 percent coverage for 10.5 knot crosswinds. Thus, the current runway orientation provides adequate wind coverage for all sizes and speeds of aircraft.

RUNWAY DIMENSIONAL REQUIREMENTS

Runway dimensional standards include the length and width of the runway as well as the dimensions associated with runway safety areas and other clearances. These requirements are based upon the design aircraft, or group of aircraft. The runway length must consider the performance characteristics of individual aircraft types, while the other dimensional standards are generally based upon the most critical airport reference code expected to use the runway. The dimensional standards are outlined for the planning period for the parallel runways.

Runway Length

The aircraft performance capability is a key factor in determining the runway length needed for takeoff and landing. The performance capability and, subsequently, the runway length requirement of a given aircraft type can be affected by the elevation of the airport, the air temperature, the gradient of the runway, and the operating weight of the aircraft.

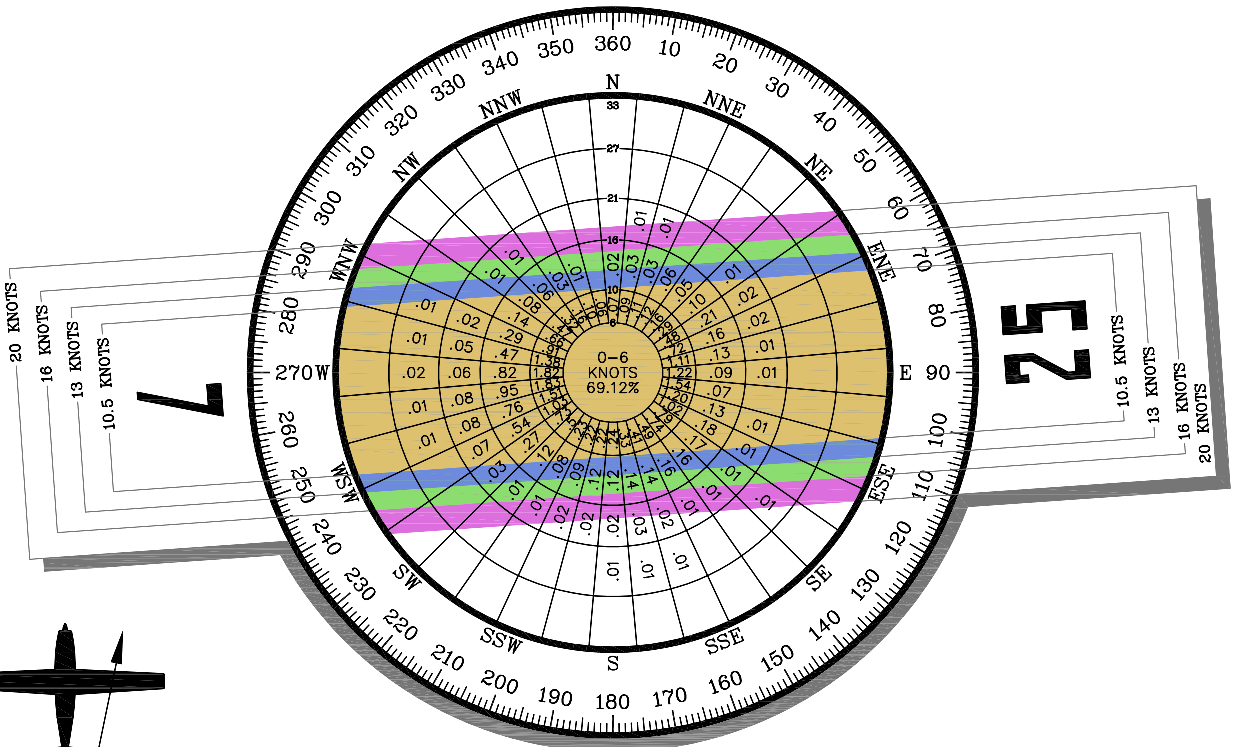
The airport elevation at Phoenix Deer Valley Airport is 1,478 feet above mean sea level (MSL). The mean maximum daily temperature during the hottest month is 105.1 degrees Fahrenheit. The gradient for Runway 7R-25L is 0.5 percent, while Runway 7L-25R has a gradient of 0.4 percent.

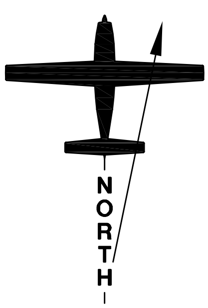
Table 3F outlines the runway length requirements for various classifications of general aviation aircraft at Phoenix Deer Valley Airport. These were derived utilizing the FAA Airport Design Computer Program for *Runway Lengths Recommended for Airport Design*. These runway lengths are based upon groupings or “families” of aircraft. As discussed earlier, the runway design required should be based upon the most critical family with at least 500 annual operations.

Small aircraft are defined as aircraft weighing 12,500 pounds or less. Small airplanes make up the vast majority of

Draft 04MP01-3D-05/11/05

ALL WEATHER WIND COVERAGE				
Runway	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 7-25	*98.54%*	*99.26%*	*99.80%*	*99.94%*





Magnetic Variance
11° 38' East (May 2005)
Annual Rate of Change
6' West (May 2005)

SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Phoenix Sky Harbor International Airport (PHX)
Phoenix, Arizona

OBSERVATIONS:
78,998 All Weather Observations
1994-2003

Exhibit 3D
WINDROSE

general aviation activity at Phoenix Deer Valley Airport and most other airports. In particular, piston-powered aircraft make up the majority of the small airplane operations. The runway length requirement for these aircraft is 4,500 feet.

Larger airplanes of 60,000 pounds or less are primarily comprised of business jets. The classifications listed on the table include 75 and 100 percent of the fleet. As indicated in the previous section, the airport hosts a wide range of business jets. **Table 3G** categorizes individual models of business jets under the appropriate family.

TABLE 3F
General Aviation Runway Length Requirements
Phoenix Deer Valley Airport

AIRPORT AND RUNWAY DATA	
Airport elevation	1,478 feet
Mean daily maximum temperature of the hottest month	105.1 F
Maximum difference in runway centerline elevation	40 feet
Length of haul for airplanes of more than 60,000 pounds	2,000 miles
Wet runway	
RUNWAY LENGTHS RECOMMENDED FOR AIRPORT DESIGN	
Small airplanes with approach speeds of less than 30 knots	340 feet
Small airplanes with approach speeds of less than 50 knots	920 feet
Small airplanes with less than 10 passenger seats	
75 percent of these small airplanes	3,200 feet
95 percent of these small airplanes	3,800 feet
100 percent of these small airplanes	**4,500 feet**
Small airplanes with 10 or more passenger seats	4,800 feet
Large airplanes of 60,000 pounds or less	
75 percent of these large airplanes at 60 percent useful load	5,600 feet
75 percent of these large airplanes at 90 percent useful load	**8,500 feet**
100 percent of these large airplanes at 60 percent useful load	7,400 feet
100 percent of these large airplanes at 90 percent useful load	11,400 feet
Airplanes of more than 60,000 pounds	Approximately 8,400 feet

Reference: Chapter Two of AC 150/5325-4B, *Runway Length Requirements for Airport Design*, no Changes included.

The airport currently has over 500 annual operations by aircraft in the family of 100 percent of the fleet of large airplanes of 60,000 pounds or less. Growing use of aircraft such as the Gulfstream IV and V and the Global Express could eventually make the larger-than-60,000-pound aircraft the most demanding family of aircraft.

A runway length of 7,400 feet would accommodate the 100 percent fleet at 60 percent of their useful load. The useful load is the maximum certificated takeoff weight minus the operating empty weight. Sixty (60) percent loading will not generally permit aircraft in this category to fly nonstop to the east coast.

A useful load of 90 percent will generally accommodate cross-country flights by these aircraft, provided they have sufficient range. A runway length of 8,500 feet will accommodate the 75 percent classification at 90 percent useful load. The table indicates a length of 11,400 feet would be required for the 100 percent category. This length, however, is dictated by older, inefficient models no longer in production. A review of the individual runway length requirements indicate that many aircraft in the 100 percent category can operate on 8,500 feet or less at 90 percent useful load.

TABLE 3G
Business Jet Planning Statistics
Phoenix Deer Valley Airport

Business Jet	ARC	MTOW #
12,500# and Under		
Cessna 500 Citation I	B-I	11,850
Cessna 501 Citation I/SP	B-I	10,600
Cessna 525 Citation Jet (CJ-1)	B-I	10,400
Raytheon 390 Premier	B-I	12,500
Cessna 525A Citation Jet (CJ-2)	B-II	12,500
Cessna 551 Citation II/SP	B-II	12,500
Lear 23	C-I	12,500
100% of Fleet Under 60,000#		
Dassault Falcon 2000	B-II	35,800
Dassault Falcon 900	B-II	45,500
Raytheon/Hawker 125-800	B-II	28,000
Lear 55	C-I	21,500
Sabreliner 75	C-I	23,300
Bombardier CL-600 Challenger	C-II	41,250
Bombardier CL-601 Challenger	C-II	41,250
Bombardier CL-604 Challenger	C-II	47,600
Cessna 650 Citation III/V	C-II	21,000
Cessna 750 Citation X	C-II	36,100
Dassault Falcon 900EX	C-II	48,300
Raytheon/Hawker 125-1000	C-II	36,000
Horizon	C-II	23,500
IAI Astra 1125	C-II	34,850
IAI Galaxy 1126	C-II	24,000
Sabreliner 65	D-I	23,500
Lear 60		
Over 60,000#		
Gulfstream III	C-II	68,700
Bombardier CL-700 Global Ex-	C-III	96,000
press	D-II	65,300
Gulfstream II	D-II	71,780
Gulfstream IV	D-III	89,000
Gulfstream V		

Business Jet	ARC	MTOW #
75% of Fleet Under 60,000#		
Aerospatiale SN-601 Cor-	B-I	14,550
vette	B-I	18,740
Dassault Falcon 10	B-I	15,000
Lear 28/29	B-I	14,630
Mitsubishi MU-300 Dia-	B-I	18,650
mond	B-II	13,300
Sabreliner 40	B-II	14,800
Cessna 550 Citation II	B-II	16,300
Cessna 550 Bravo	B-II	15,900
Cessna 552/T-47A	B-II	16,300
Cessna S550 Citation S/II	B-II	16,830
Cessna 560 Citation V Ultra	B-II	20,000
Cessna 560 Citation Encore	B-II	28,660
Cessna 560 Citation Excel	B-II	37,480
Dassault Falcon 20	C-I	16,100
Dassault Falcon 50	C-I	23,500
Beechjet 400A	C-I	23,500
IAI Jet Commander 1121	C-I	13,000
IAI Westwind 1123/1124	C-I	15,000
Lear 24	C-I	16,500
Lear 25	C-I	18,300
Lear 31	C-I	20,200
Lear 35/36	C-I	20,200
Lear 45	C-II	24,200
Sabreliner 60	C-II	23,000
BAe 125-700	C-II	23,300
Cessna 650 Citation VII	C-II	25,000
Hawker-Siddeley 125-400	C-II	23,300
Hawker-Siddeley 125-600		
Sabreliner 75a/80		

ARC – Airport Reference Code
MTOW # - Maximum Certificated Takeoff Weight (pounds)

The airport could also eventually have enough operations by an aircraft over 60,000 pounds to qualify as the most demanding aircraft. These potential aircraft include the Gulfstream II, III, IV, and V, as well as the Global Express. The table indicates that these aircraft could operate on at least a 2,000-mile trip length (equivalent of Phoenix to Boston) from 8,400 feet of runway at Phoenix Deer Valley Airport.

The Gulfstream V and Global Express were also examined specifically at 90 percent of their useful load. The Gulfstream V would require 8,200 feet of runway length, while the Global Express would require 8,000 feet.

The longest runway available at Phoenix Deer Valley Airport currently provides a takeoff length of 8,208 feet. This is an adequate length for the Gulfstream V, Global Express, and most operations by the range of business jets weighing less than 60,000 pounds. While a length of 8,500 feet would be optimal, the current length appears adequate for regular business jet operations from the airport.

The parallel runway is currently 4,500 feet long. This is adequate for use by small airplanes with less than 10 passenger seats. These aircraft comprise more than 90 percent of the operations at the airport.

The parallel runway enhances the capacity of the airfield. If the runway is needed for capacity purposes, the runway can be planned to a length equal to the primary runway. Since over 90 percent of the aircraft using the airport are small aircraft, the lesser parallel runway provides most of the capacity benefits. The parallel runway, however, also acts as a backup runway, keeping the airport open when the primary runway is temporarily closed for maintenance, emergencies, etc. If adequate length is not available during these periods, business jets must divert to an airport with sufficient length.

While the primary purpose of the parallel runway will be to serve small airplanes, the ability to accommodate some business jet operations can further enhance the operational efficiency of the airfield. A length of 7,400 feet would best serve business jets, but 5,600 feet would serve at least the 75 percent fleet. The feasibility of providing this capability will be evaluated in the next chapter.

Pavement Strength

An important feature of airfield pavement is the ability to withstand repeated use by aircraft of significant weight. As part of the 2007 Pavement Management Program Update for Phoenix Deer Valley Airport, nondestructive pavement testing was performed of the airfield pavements in March 2007. From this testing, the allowable loads were calculated for the various pavement sections using Airfield Pavement Evaluation (APE) software. This methodology takes into account total traffic using the airport over a 20-year period. The pavement strengths discussed in this section are based upon the weakest pavement section for each runway and the taxiways serving them.

The testing determined the minimum pavement strength of Runway 7R-25L to be 24,000 pounds single wheel loading (SWL) and 46,000 pounds dual wheel loading (DWL).

Table 3G depicts the maximum takeoff weight of the range of business jets expected to use DVT. The Gulfstream V and Global Express are the largest aircraft to use the airport. The Gulfstream V has a maximum takeoff weight of 89,000 pounds on dual wheel gear. A similar aircraft, the Bombardier Global Express, weighs a maximum of 96,000 pounds. Current operations are infrequent by these aircraft, but forecasts indicate that more demand for use of the airport by these aircraft can be anticipated. This would require a pavement strength of up to 100,000 pounds DWL.

Runway 7L-25R was determined to have a strength of 70,000 pounds SWL and 117,000 pounds DWL. This strength is more than adequate to accommodate the full range of ARC A-I and B-I aircraft on a regular basis. It is also strong enough to accommodate business jets regularly.

In support of the runway system, the taxiway system should be designed for the same pavement strengths. Currently, the north side parallel Taxiway A and its exits have a minimum pavement strength of 21,000 pounds SWL and 48,000 pounds DWL. This can effectively accommodate all business jet aircraft listed in **Table 3G** at less than 60,000 pounds.

The mid-field parallel Taxiway B has a minimum pavement strength of 43,000 pounds SWL and 100,000 pounds DWL. This is adequate for the future critical aircraft.

South parallel Taxiway C has a minimum pavement strength of 27,000 pounds SWL and 62,000 pounds DWL. This is adequate for the short term but will need to be strengthened as traffic by business jets over 60,000 pounds increases.

The pavement strengths were reevaluated to determine the capability of the runways to accommodate a short term influx of activity by heavier business jets in association with several regional events including the January 2008 Super Bowl. On October 11, 2007, the Deputy Aviation Director, a Professional Engineer, certified temporary pavement strengths valid through November 15, 2008.

According to the report, the primary Runway 7R-25L is strength-rated at 20,000 pounds SWL; 91,000 pounds DWL; and 255,000 pounds DTWL. This strength rating can be sustained with proper pavement maintenance and rehabilitation. The parallel Runway 7L-25R remains strength-rated at 70,000 pounds SWL and 117,000 pounds DWL.

Dimensional Design Standards

Runway dimensional design standards define the widths and clearances required to optimize safe operations in the landing and takeoff area. These dimensional standards vary depending upon the ARC for each runway. **Table 3H** outlines key dimensional standards for the airport reference codes most applicable to Phoenix Deer Valley Airport now and in the future.

The primary runway (7R-25L) at Phoenix Deer Valley Airport is currently designed to C-II standards. Planning and development considerations should take into account the potential for D-III aircraft in the future. Runway 7L-25R is currently designed to B-I standards. These standards are adequate for at least the short term; however, consideration should be given to upgrading the parallel runway to C-II for the long term. The following considers those areas where standards will need to be met:

Runway Width – The current width of Runway 7R-25L (100 feet) is adequate for both C-II and D-III design. The 75-foot width of the parallel runway is adequate for its current use, but would need to be widened to 100 feet if upgraded to C-II.

TABLE 3H
Airfield Design Standards
Phoenix Deer Valley Airport

	Runway 7R-25L			Runway 7L-25R
Airport Reference Code (ARC)	**Existing**	**C-II (ft.)***	**D-III (ft.)**	**Existing B-I (ft.)**
Runway Width	100	100	100	60
Runway Safety Area				
Width	500	500	520	120
Length Beyond End:				
7R/7L	**992**	1,000	1,000	240
25L/25R	**700**	1,000	1,000	240
Runway Object Free Area				
Width	800	800	800	250
Length Beyond End				
7R/7L	**992**	1,000	1,000	240
25L/25R	**700**	1,000	1,000	240
Runway Blast Pad				
Width	**100**	120	140	80
Length				
7R/7L	**154**	150	200	60
25L/25R	**150**	150	200	60
Runway Centerline to:				
Holding Position	**200**	250	265	125
Parallel Taxiway	**300**	300	400	150
Parallel Runway	700	700	700	700
Taxiway Width	**40**	35	50	29.8
Taxiway Centerline to:				
Fixed or Moveable Object	**66**	65.5	80	44.5
Parallel Taxilane	NA	97	130	69
Taxilane Centerline to:				
Fixed or Moveable Object	NA	57.5	70	39.5
Parallel Taxilane	NA	97	120	64
Runway Protection Zones – One-mile or greater visibility				
Inner Width	500	500	500	250
Length	1,700	1,700	1,700	1,000
Outer Width	1,010	1,010	1,010	450
Category I				
Inner Width	NA	1,000	1,000	NA
Length	NA	2,500	2,500	NA
Outer Width	NA	1,750	1,750	NA

Boldface indicates standard not met.
* Also applies to an upgraded Runway 7L-25R

Runway Safety Area - The runway safety area (RSA) is defined in FAA Advisory Circular 150/5300-13 Change 8, *Airport Design*, as a surface surrounding the runway, prepared or suitable for reducing the risk of damage to airplanes in the event of an overshoot, undershoot, or excursion from the runway. The RSA is centered on the runway and extends beyond either end. The FAA requires the RSA to be cleared and graded, drained by grading or storm sewers, capable of accommodating fire and rescue vehicles, and free of obstacles not fixed by navigational purpose.

The RSA standard for all Category C aircraft is 500 feet wide and extends 1,000 feet beyond each runway end. The primary runway has at least 500 feet of safety area width; however, the existing RSA does not extend for the full 1,000 feet beyond either end of Runway 7R-25L. The perimeter service road encroaches on the RSA off each runway end.

The parallel runway currently meets the RSA standard for B-I aircraft. Upgrading to Category C would require widening the RSA from 150 feet to 500 feet and extending it from 240 feet to 1,000 feet beyond the ends. The existing parallel taxiways would be in the Approach Category C RSA.

Runway Object Free Area - The object free area (OFA) is an area centered on the runway to enhance the safety of aircraft operations by having an area free of objects, except for objects that need to be located in the OFA for air navigation or ground maneuvering purposes. The OFA must provide clearance of all ground-based objects protruding above the runway safety area (RSA) edge elevation, unless the object is fixed by a function serving air or ground navigation. The OFA is the same for Category C and D aircraft. Like the RSA, the OFA extends for 1,000 beyond the runway end, but it is 800 feet wide. Primary Runway 7R-25L meets the OFA width standard, but the perimeter roads encroach upon the extended OFA of each runway end.

Parallel Runway 7L-25R meets the B-I OFA standard, but the OFA would need to be expanded if the runway were to be upgraded to Approach Category C.

Runway Blast Pad - The blast pad is a surface adjacent to the ends of the runways provided to reduce the erosive effect of jet blast and propeller wash. Primary Runway 7R-25L is equipped with 100-foot by 150-foot blasts pads off each end. This is an adequate length for C-II design aircraft, but should be 120 feet wide. For D-III design aircraft, a 140-foot by 200-foot pad is required. The parallel runway does not currently have blast pads, but a 60-foot by 80-foot pad would meet B-I standards.

Parallel Runway Separation - The parallel runways at DVT currently have a centerline separation of 700 feet. This meets the minimum standard for the existing and future critical aircraft under visual flight rules (VFR).

Holding Position Separation – The current hold positions on the primary runway are marked 150 feet from the runway centerline. The standard for Category C aircraft is 250 feet. For Category D, the hold positions would need to be moved back to 265 feet. The hold positions on the parallel runway are marked 125 feet from the runway centerline. This meets the B-I standard for small airplanes, but would need to be relocated for any potential upgrade.

Runway Protection Zones – The runway protection zone (RPZ) is an area off the runway end to enhance the protection of people and property on the ground. This is best achieved through airport owner control over the RPZs. Such control includes maintaining RPZ areas clear of incompatible objects and activities.

The RPZ is trapezoidal in shape and is centered on the extended runway centerline. The dimensions of the RPZ are a function of the critical aircraft and the approach visibility minimum associated with the runway. **Table 3H** depicts the requirements for runways with visibilities of one mile or more and for runways with Category I visibility (less than ¾ mile).

The RPZs off primary Runway 7R-25L both extend beyond the current airport property boundaries. If an approach were to be upgraded to Category I in the future, the area within the RPZ would expand further beyond the current property boundaries. The RPZs for the parallel runway are currently contained within the airport's boundaries. Should the runway be upgraded to Category C, the RPZ would extend beyond at least the west property line.

TAXIWAY REQUIREMENTS

Taxiways are constructed primarily to facilitate aircraft movements to and from the runway system. Some taxiways are necessary simply to provide access between the aprons and runways, whereas other taxiways become necessary as activity increases at an airport to provide safe and efficient use of the airfield.

As detailed in Chapter One, Runway 7R-25L and 7L-25R each are served by a full-length parallel taxiway. Runway 7L-25R has parallel taxiways on both sides. Both extend beyond the ends of the runway. Parallel Taxiway B's location between the runways enhances circulation and efficiency.

Table 3H outlines the runway to taxiway centerline separation standards. Parallel Taxiway C is 300 feet from primary Runway 7R-25L. This is adequate for the current C-II standards, but D-III standards would call for a 400-foot separation. Parallel Taxiways A and B are each located 200 feet from the centerline of parallel Runway 7L-25R. This exceeds the standard for B-I small airplanes, but is 100 feet less than the C-II standard.

Exit taxiways provide a means to enter and exit the runways at various points on the airfield. The type and number of exit taxiways can have a direct impact on the capacity and efficiency of the airport as a whole. Runway 7R-25L has a total of 12 exit taxiways on the south side of the runway and five on the north side of the runway. Runway 7L-25R has a total of five exit taxiways on the north side of the runway and four on the south side of the runway.

Exit taxiways are most effective when planned at least 800 feet apart. Therefore, the 12 exits from Runway 7R-25L are essentially equivalent to seven. The five exits on Runway 7L-25R are essentially equivalent to three. Some of the closely-spaced exits are directional, angled exits, and others act as bypass taxiways at the ends of the runway, so they serve other purposes. Potential locations for new exit taxiways that may improve capacity or efficiency will be examined in Chapter Four – Alternatives.

Right-angled exits require an aircraft to be nearly stopped before it can safely exit the runway. Angled exits allow aircraft to use a higher safe exit speed while exiting the runway. There are presently five angled exits on Runway 7R-25L (three serving Runway 25L and two serving Runway 7R) and none on Runway 7L-25R.

Dimensional standards for the taxiways are depicted on **Table 3G**. The airfield taxiways are all 40 feet wide. This exceeds the Design Group II standard of 35 feet. If the airport is to regularly service business jets in Design Group III, the taxiways will need to be widened to 50 feet. The associated taxiways for Runway 7L-25R currently meet the design requirements for Design Group II and should be maintained through the planning period.

Holding aprons and bypass taxiways can also improve the efficiency of the taxiway system. Currently, all runway ends have either holding aprons or bypass taxiways. The holding apron for Runway 7L is located south of the threshold, causing aircraft from the north apron to taxi around the end of Runway 7L on Taxiway B3. A holding apron or a bypass taxiway should be considered north of the Runway 7L threshold, near Taxiway A4. The type and placement will be discussed further in the next chapter.

NAVIGATIONAL APPROACH AIDS

Navigational aids provide two primary services to airport operations: precision guidance to a specific runway, and/or non-precision guidance to a runway or the airport itself. The basic difference between a precision and non-precision navigational aid is that the former provides electronic descent, alignment (course), and position guidance, while the non-precision navigational aid provides only alignment and position location information. The necessity for such equipment is usually determined by design standards predicated on safety considerations and operational needs. The type, purpose, and volume of aviation activity expected at the airport are factors in the determination of the airport's eligibility for navigational aids.

The advancement of technology has been one of the most important factors in the growth of the aviation industry in the twentieth century. Many of the civil aviation improvements have been derived and enhanced from initial development for military purposes. The use of orbiting satellites to confirm an aircraft's location is one of the latest military developments to be made available to the civil aviation community.

Global positioning systems (GPS) use two or more satellites to derive an aircraft's location by a triangulation method. The accuracy of these systems has been remarkable, with initial degrees of error of only a few meters. As the technology improves, it is anticipated that GPS may be able to provide accurate enough positional information to allow Category II and III precision instrument approaches, independent of any existing ground-based navigational facilities. In addition to the navigational benefits, it has been estimated that GPS equipment will be much less costly than existing precision instrument landing systems.

Currently, the best minimums to Phoenix Deer Valley Airport are provided by the GPS approaches to Runways 25L and 7R. The best approach minimums are to Runway 7R, with 600-foot above ground level (AGL) cloud ceilings and one-mile visibility. While Phoenix Deer Valley Airport enjoys an unusually high percentage of VFR weather (99 percent), the addition of a CAT I approach would serve the needs of the flight training schools as well as assist corporate aircraft operations.

As GPS technology continues to improve and change, planning at airports has begun to shift toward facility design requirements rather than the navaids. In order to qualify for future CAT I minimums with a GPS approach, additional approach lighting may be necessary, as well as a review of all runway/taxiway separation distances.

Visual glide slope indicators provide visual descent guidance information during approach. There are two forms of these aids that have been regularly installed by the FAA at airports. They include precision approach path indicators (PAPI) and visual approach path indicators (VASI). At Phoenix Deer Valley Airport, each runway end is currently equipped with a PAPI-2. These should be upgraded to PAPI-4 systems in the future. This upgrade would provide a greater level of precision for pilots to maintain the correct approach slope.

Two types of automated weather observing systems are currently deployed at airports around the country. Automated Surface Observing System (ASOS) and Automated Weather Observing System (AWOS) both measure and process surface weather observations 24 hours per day, with reporting varying from one minute to hourly. The systems provide near real-time measurements of atmospheric conditions.

ASOS systems are typically commissioned by the National Weather Service or the Department of Defense. AWOS systems are often commissioned by the Federal Aviation Administration for airports that meet criteria of either 8,250 annual itinerant operations or 75,500 annual local operations. Phoenix Deer Valley Airport currently has an ASOS operating on site.

The ASOS at Phoenix Deer Valley Airport is only available via a telephone number or through communication with the tower. This system should be made available via aircraft radio transponder for times when the tower is closed.

Phoenix Deer Valley Airport is presently served by an airport traffic control tower (ATCT) operated from 6:00 a.m. to 9:00 p.m. Chapter Two included an analysis of operations that occur during hours when the tower is closed. Three percent of the airport's traffic, or over 11,000 annual operations, occur during the hours when the tower is closed. As traffic continues to grow, so will operations when the tower is not operating. Thus, ATCT hours of operation may need to be increased in the future.

AIRFIELD LIGHTING, MARKING, AND SIGNAGE

Runway identification lighting provides the pilot with a rapid and positive identification of the runway end. The most basic system involves runway end identifier lights (REILs). REILs should be considered for all lighted runways not planned for a more sophisticated approach light system (ALS). REILs are installed at each runway end.

The medium intensity runway edge lighting (MIRL) currently available along both runways is appropriate and should be maintained through the planning period. The taxiway system is lighted with medium intensity taxiway lighting (MITL) which will be adequate for the planning period. MITL should be planned for all future taxiways as well.

An ALS should be considered along with any Category I or other precision instrument approach. This would most likely be a medium intensity approach light system with runway alignment indicator lights (MALSR). Lighted airfield signage for both runways currently meets FAA standards. This will need to be extended to any new airfield pavements as well.

Nonprecision runway markings should be maintained on both runways. Basic taxiway marking will continue to be adequate and should be applied to all new taxiways as well. Should Runway 7R-25L acquire a CAT I approach in the future, precision runway markings will need to be implemented.

The airport also has a lighted wind cone and segmented circle which provides pilots with information about wind conditions and the airport traffic pattern. In addition, an airport beacon assists in identifying the airport from the air at night. Each of these facilities should be maintained in the future. Additional wind cones should be considered near the ends of each runway.

RUNWAY SAFETY ACTION PLAN

On November 17, 2005, the FAA Office of Runway Safety & Operational Services, Western-Pacific Region (AWP-1R), visited Phoenix Deer Valley Airport. During the visit, the team met with airport and air traffic management for the purpose of updating the DVT Runway Safety Action Plan (RSAP).

The recommendations of this group were presented to airport administration in April 2006. The recommendations are considered of the highest priority as they are related to safety issues. Some of the recommendations are as follows:

- Improve the runway safety areas and ensure they are free of ruts, humps, depressions, and other potentially hazardous conditions.

- Various lighting, signage, and marking improvements.

- Explore options for outfitting off-airport emergency responders with communications equipment.

- Develop a plan to deconflict helicopter and fixed wing operations.
- Develop larger and more numerous aircraft run-up areas.

These recommendations will be incorporated into the alternatives discussion and recommended concept of this master plan. The final letter with the list of recommendations from FAA is included in **Appendix E** of this master plan.

GENERAL AVIATION FACILITIES

General aviation facilities are those necessary for handling general aviation aircraft and passengers while on the ground. This section is devoted to identifying future facility needs during the planning period for the following types of facilities normally associated with general aviation terminal areas:

- Hangars
- Aircraft Parking Apron
- General Aviation Terminal Services
- Airport Access
- General Aviation Automobile Parking

HANGARS

The demand for hangar facilities typically depends on the number and type of aircraft expected to be based at the airport. Hangar facilities are generally classified as shade hangars or T-hangars, and conventional hangars. Conventional hangars can include individual hangars or multi-aircraft hangars. These different types of hangars offer varying levels of privacy, security, and protection from the elements.

Demand for hangars varies with the number of aircraft based at the airport. Another important factor is the type of based aircraft. Smaller single-engine aircraft usually prefer shade or T-hangars, while larger business jets will prefer conventional/executive hangars. Rental costs will also be a factor in the choice.

Presently, all of the T-hangar positions on the airfield are occupied and there is a waiting list for units. The airport has 58 T-hangar storage facilities, providing 768 storage units. T-hangar space available at the airport totals approximately 953,600 square feet for aircraft storage. The airport also has 12 shade hangar structures providing 248 storage positions, encompassing 172,800 square feet of storage space. Analysis of future T-hangar and shade hangar requirements, as depicted on **Table 3J**, indicates additional T-hangar or shade hangar positions which may be needed by the long range planning horizon.

The 11 conventional hangars make up a much smaller portion of the total hangar space at the airport. These hangars are utilized by corporate flight departments as well as private entities. Typical users of these facilities include small and medium aircraft. As plans to develop a new corporate hangar subdivision go forward, new airport tenants are expected to bring aircraft to the airport. These aircraft would most likely be turboprop and larger business jet aircraft. The corporate hangar subdivision will be located to the east of the police facility and would include 15 separate parcels of land varying in size from 2.0 acres to 2.4 acres. Each parcel would have runway access via new taxilanes constructed off of Taxiway C. The conventional hangar forecast takes into account the addition of this corporate hangar subdivision.

Requirements for the maintenance and FBO hangar area were estimated at 10 percent of total T-hangar and conventional hangar area. It should be noted that FBO hangars are cross-utilized for storage and aircraft maintenance. They are also sometimes used to store transient aircraft overnight. Existing service hangar area includes each of the FBO hangars, and the aircraft maintenance bays at the west end of the airport.

Table 3J compares the existing hangar space to the future hangar requirements. It is evident from the table there is a need for additional enclosed hangar storage space throughout the planning period. The analysis also indicates a potential need for additional service hangar space through the planning period.

TABLE 3J
Hangar Storage Requirements
Phoenix Deer Valley Airport

	Existing	Short Term (± 5)	Intermediate Term (± 10)	Long Term (± 20)
Hangar Positions				
Shade/T-Hangars	1,016	1,193	1,373	1,676
Conventional	47	73	103	180
Total Aircraft to be Hangared	1,063	1,254	1,476	1,856
Hangar Area Requirements				
T-Hangars (s.f.)	1,126,400	1,372,000	1,530,000	1,927,000
Conventional (s.f.)	123,250	190,000	268,000	468,000
Service Hangar Area (s.f.)	38,850	156,000	180,000	240,000
Total Hangar Area (s.f.)	1,288,500	1,718,000	1,978,000	2,635,000

AIRCRAFT PARKING APRON

A parking apron should be provided for at least the number of locally-based aircraft that are not stored in hangars, as well as transient aircraft. The airport provides approximately 253,960 square yards of total apron space to the adjacent FBOs and other hangar storage areas. The number of local tie-downs and ramp space for the planning period is presented in **Table 3K.**

FAA Advisory Circular 150/5300-13, *Airport Design*, suggests a methodology by which transient apron requirements can be determined from knowledge of busy-day operations. At Phoenix Deer Valley Airport, the number of transient spaces required was determined to be approximately 20 percent of busy-day itinerant operations.

A planning criterion of 700 square yards per aircraft was applied to the number of itinerant spaces to determine future transient apron requirements for single and multi-engine aircraft. A planning criterion of 360 square yards per based aircraft was applied to the number of local positions.

Local ramp aprons and itinerant apron spaces will need to be expanded to accommodate the projected demand in the long-term.

TABLE 3K
Aircraft Parking Apron Requirements
Phoenix Deer Valley Airport

	Existing	Short Term (± 5)	Intermediate Term (± 10)	Long Term (± 20)
Non-hangared Based Aircraft	223	258	272	328
Busy Day Itinerant Operations	532	696	794	991
Local Ramp Positions	320	258	272	328
Transient Ramp Positions	52	139	159	198
Total Ramp Positions	372	503	431	526
Apron Area (s.y.)	**184,400**	**190,000**	**209,000**	**257,000**

GENERAL AVIATION TERMINAL SERVICES

The general aviation facilities are often the first impression of the community that corporate officials or vacationers will encounter. General aviation terminal facilities at an airport provide space for passenger waiting, pilots' lounge and flight planning, concessions, management, storage, and various other needs. This can be accommodated in a single facility or spread throughout several fixed base operators.

The methodology used in estimating general aviation terminal facility needs was based upon the number of airport users expected to utilize general aviation facilities during the design hour, as well as FAA guidelines.

Space requirements for terminal facilities were based on providing 90 square feet per design hour itinerant passenger. Besides the terminal building, each fixed base operator provides some space for terminal services within their facilities. **Table 3L** outlines the general space requirements for general aviation terminal services at Phoenix Deer Valley Airport through the long term planning horizon. As shown in the table, the present general aviation terminal facilities are currently adequate through the short term. Additional space will need to be considered for the intermediate and long terms.

TABLE 3L
GA Terminal Services Requirements
Phoenix Deer Valley Airport

	Available	Existing	Short Term (± 5)	Intermediate Term (± 10)	Long Term (± 20)
Itinerant Operations					
Annual		142,020	185,800	206,500	247,800
Design Hour		54	70	78	94
Pax/OP		1.9	1.9	1.9	1.9
Des. HR Pax		103	133	148	179
Terminal Space (s.f.)	11,900	9,180	11,970	13,320	16,020

AIRPORT ACCESS

The airport has two primary access points. On the south side, it is the north leg of the intersection of Deer Valley Road and Seventh Avenue. On the north side, it is the intersection of Airport Boulevard with Seventh Street. Using trip generation estimates from the *Institute of Transportation Engineers (ITE) Trip Generation Report*, DVT traffic is estimated to currently generate 4,300 daily vehicle trips based upon peak month operations and based aircraft. This can be expected to grow to 7,500 daily trips by the long range planning horizon. Based upon the split of based aircraft and the location of the flight schools and the fixed base operators, it is estimated that approximately 70 percent of the trips are to the south side airport facilities.

Deer Valley Road is a major east-west six-lane arterial along the south side of the airport. In recent years, Deer Valley Road west of Seventh Street has been improved to a six-lane roadway with a median and turn-lanes. A 2002 City of Phoenix traffic count indicated that the roadway carried an average daily traffic (ADT) volume of 28,600 vehicles west of 19th Avenue, 27,000 between 19th and Seventh Avenues, and 20,200 between Seventh Avenue and Seventh Street. East of Seventh Street, Deer Valley Road reduces to two lanes. In 2002, this section carried ADT of 17,600 vehicles. The Regional Transportation Plan (RTP) recommends that Deer Valley Road be widened to six lanes east of Seventh Street.

Nineteenth Avenue is a four-lane arterial south of Deer Valley Road. In 2002, 19th Avenue carried an ADT of 18,700 vehicles south of Deer Valley Road and 7,500 north of it. The RTP recommends that 19th Avenue be widened to four lanes in the future. The RTP also indicates that the signalized intersection of 19th Avenue and Deer Valley Road will experience an unacceptable level of service (LOS E or F) during peak periods in the future.

Seventh Avenue is a four-lane arterial roadway south of Deer Valley Road. The airport entrance is the north leg of this intersection. This intersection is expected to remain above Level of Service E in the future.

Seventh Street is a four-lane arterial road south of Deer Valley Road and a two-lane roadway to the north. In 2002, Seventh Street carried ADT of 15,900 vehicles south and 7,200 north. The RTP calls for the north leg of Seventh Street to be developed as a four-lane arterial roadway in the future. The signalized intersection with Deer Valley Road is expected to be at Level of Service E or F during peak periods in the future.

Seventh Street also intersects with the north side airport entrance of Airport Boulevard. Airport Boulevard is a two-lane connector road. It is anticipated that this intersection will need to be signalized in the future as traffic grows and after Seventh Street becomes a four-lane arterial roadway.

Currently, airport users arriving from the west and destined to the north side of the airport have to travel around the airport via Deer Valley Road and 7^{th} Street. The north side airport tenants have advocated an airport entrance from 19^{th} Avenue. This possibility will be examined further in the alternatives chapter.

GENERAL AVIATION AUTOMOBILE PARKING

Vehicle parking requirements for general aviation were also examined. Space determinations were based on an evaluation of the existing airport use, as well as industry standards. General Aviation spaces were calculated by multiplying design hour itinerant passengers by the industry standard of 1.8. Additional factors were added based upon based aircraft and daily flight school students. Auto parking requirements are summarized in **Table 3M**.

TABLE 3M
Automobile Parking Requirements
Phoenix Deer Valley Airport

			Future Requirements		
	Available	**Base Year**	**Short Term (± 5)**	**Intermediate Term (± 10)**	**Long Term (± 20)**
Design Hour Itinerant Passengers		103	133	148	179
Based Aircraft		1,252	1,524	1,748	2,185
Flight Schools (Daily Students)		190	200	210	220
GA Parking Spaces	**1,035**	**688**	**820**	**913**	**1,088**

The airport currently has 374 parking spaces in its public parking lot, with an additional 661 parking spaces used by based aircraft owners located in the T-hangar areas. The analysis indicates that the available parking meets the needs of the airport in the short and intermediate terms. Parking problems have arisen, however, in the main parking lot in front of the terminal building. This may require relocating some users to other available spaces to provide more convenient parking. Overall, parking spaces are adequate but the location where they are most needed will be addressed in the next chapter.

SUPPORT FACILITIES

Various facilities that do not logically fall within classifications of airfield, terminal building, or general aviation requirements have been identified for these remaining facilities:

AIRPORT RESCUE AND FIREFIGHTING

The requirements for Airport Rescue and Firefighting (ARFF) equipment at an airport are determined by whether it is certified as an FAR Part 139 airport by the FAA. Phoenix Deer Valley is not a Part 139 airport; therefore, there is no requirement for ARFF facilities.

Fire station number 36 is located at 21602 N. 9th Avenue, one block south of the main entrance to the airport. This station is home to Paramedic/Engine-36, Bruch-36, Tanker-36, and Peak Time Rescue-36. This station would be the first responder to any airport emergencies.

The resources both on- and off-airport are appropriate for the size aircraft and traffic activity at the airport.

FUEL STORAGE

Both FBOs at the airport operate a fuel facility with 20,000 gallons of Avgas, and 20,000 gallons of Jet A fuel. These facilities are located on the south side of the airport. With a large portion of based aircraft in the north T-hangar area, there is demand for a self-fueling facility on the north apron. A fuel facility on the north apron would reduce the amount of aircraft crossing both runways to access fuel facilities. As of October 2007, a self-serve capability is being designed.

Fuel storage is typically based upon maintaining a one-month supply of fuel during an average month; however, more frequent deliveries can reduce the fuel storage capacity requirement. Over the past three years, Avgas fuel sales have averaged 3.8 gallons per operation. This ratio was utilized to project future Avgas sales. **Table 3N** presents future Avgas storage requirements for the airport based upon a two-week supply during the peak month.

TABLE 3N
Fuel Storage Requirements
Phoenix Deer Valley Airport

	Available	Current Need	Short Term (± 5)	Intermediate Term (± 10)	Long Term (± 20)
Design Day Operations		1,102	1,428	1,628	2,029
Two-Week Operations		15,428	19,992	22,792	28,406
Two-Week Fuel Storage Requirements*					
Avgas (gal.)	40,000	58,040	76,000	86,600	108,000
Jet A (gal.)	40,000	56,600	73,300	83,600	104,200

* Note: Recommended minimum tank size – 12,000 gallons.

Projections of future Jet A fuel storage requirements were based upon an average of 183.4 gallons per turbine operation. Turbine operations were estimated at two percent of the total two-week operations. Based upon these ratios, turbine operations will reach almost 13,000 operations annually in the long range. **Table 3N** presents the Jet A fuel storage requirements.

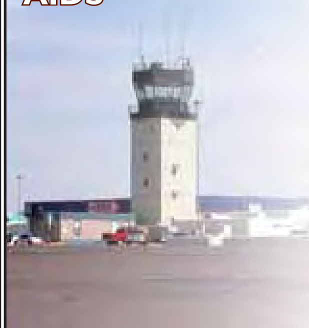
Pending specific FBO needs, additional storage may become necessary in the short term, with needs more than doubling over the long term.

SUMMARY

The intent of this chapter has been to outline the facilities required to meet the "unconstrained" aviation demands projected for Phoenix Deer Valley Airport through the long term planning horizon. A summary of the airfield and general aviation facility requirements are presented on **Exhibits 3E and 3F**.

Following the "unconstrained" facility requirements determination, the next step is to develop a direction for development to best serve the airport's role. The remainder of the Master Plan will be devoted to outlining this direction, its schedule, and its costs.

04MP01-3E-1/17/07

	EXISTING FACILITY	SHORT TERM NEED	LONG TERM NEED
RUNWAYS 	**Runway 7R-25L** 8,208' x 100' 20,000# SWL* 91,000# DWL 255,000# DTWL ARC C-II **Runway 7L-25R** 4,500' x 75' 117,000# DWL ARC B-I 70,000# SWL	**Runway 7R-25L** 8,200' x 100' 72,000# DWL • ARC D-II Improve & Extend RSA / OFA Both Ends Pavement Strength Maintenance **Runway 7L-25R** 4,500' x 75' ARC B-I Pavement Strength Maintenance	Airfield Capacity Improvements **Runway 7R-25L** 8,200' x 100' 100,000# DWL ARC D-III Pavement Strength Maintenance **Runway 7L-25R** Up to 7,400' x 100' ARC C-II Pavement Strength Maintenance
TAXIWAYS 	**Runway 7R-25L** Full Parallel 10 Exits, 40' Wide 62,000# DWL Bypass Taxiway **Runway 7L-25R** Full Parallels (both sides) 5 Exits, 40' Wide 48,000# DWL Bypass Taxiway	**Runway 7R-25L** Full Parallel 10 Exits, 40' Wide 72,000# DWL Bypass Taxiway **Runway 7L-25R** Add 2 Exits Add Holding Apron 20,000# DWL North of 7L	**Runway 7R-25L** Full Parallel 10 Exits, 40' Wide 100,000# DWL **Runway 7L-25R** Full Parallels (both sides) 7 Exits, 40' Wide up to 72,000# DWL Holding Aprons
NAVIGATIONAL AIDS 	ATCT (6 a.m. - 9 p.m.) ASOS RN AV (GPS) **Runway 7R-25L** RN AV (GPS) PAPI-2 **Runway 7L-25R** PAPI-2	ATCT (5 a.m. - 11 p.m.) ASOS RN AV (GPS) **Runway 7R-25L** RN AV (GPS) PAPI-4 **Runway 7L-25R** PAPI-2	ATCT (24-hour) ASOS GPS **Runway 7R-25L** CAT-I GPS (25) GPS PAPI-4 **Runway 7L-25R** PAPI-4 GPS
LIGHTING AND MARKING 	Airport Beacon Segmented Circle MITL Basic Taxiway Marking **Runway 7R-25L** MIRL • REILs Nonprecision Marking **Runway 7L-25R** MIRL • REILs Nonprecision Marking	Same **Runway 7R-25L** Same **Runway 7L-25R** Same	Same **Runway 7R-25L** MIRL • MALSR (25L) REILs (7R) Precision Marking **Runway 7L-25R** Same

* - Pavement strengths from City of Phoenix memo by David L. Hensley, Deputy Aviation Director, dated Oct. 11, 2007

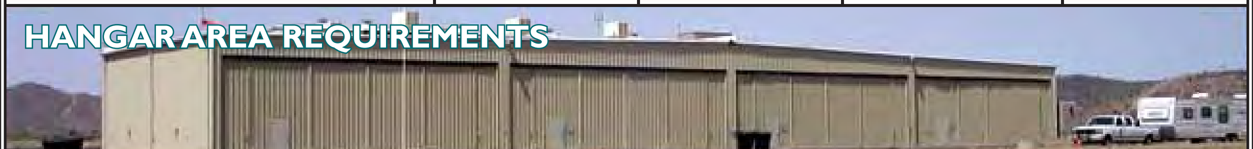
Exhibit 3E
"UNCONSTRAINED"
AIRFIELD REQUIREMENTS

04MP01-3F-9/1/05

AIRCRAFT STORAGE HANGAR REQUIREMENTS

	EXISTING	SHORT TERM NEED	INTERMEDIATE NEED	LONG TERM NEED
Aircraft to be Hangared	1,063	1,266	1,476	1,856
T-Hangars / Shade Hangars	1,016	1,193	1,373	1,676
Conventional Hangar Positions	47	73	103	180

HANGAR AREA REQUIREMENTS



	EXISTING	SHORT TERM NEED	INTERMEDIATE NEED	LONG TERM NEED
T-Hangar Area (s.f.)	1,126,400	1,372,000	1,530,000	1,927,000
Conventional Hangar Storage Area	123,250	190,000	268,000	468,000
Service Hangar Area	38,850	156,000	180,000	240,000
Total Hangar Area (s.f.)	***1,288,500***	***1,718,000***	***1,978,000***	***2,635,000***

AIRCRAFT PARKING APRON REQUIREMENTS

	EXISTING	SHORT TERM NEED	INTERMEDIATE NEED	LONG TERM NEED
Single, Multi-Engine Transient Aircraft Positions	52	139	159	198
Local Ramp Positions	320	258	272	328
Total Ramp Positions	***372***	***397***	***431***	***576***
Total Apron Area (s.y.)	***184,400***	***190,000***	***209,000***	***257,000***

FUEL STORAGE

	EXISTING	SHORT TERM NEED	INTERMEDIATE NEED	LONG TERM NEED
Av Gas (gallons)	40,000	76,000	86,600	108,000
Jet A (gallons)	40,000	73,300	83,600	104,200

TERMINAL SPACE AND VEHICLE PARKING

	EXISTING	SHORT TERM NEED	INTERMEDIATE NEED	LONG TERM NEED
General Aviation Parking (spaces)	1,035	820	913	1,088
Terminal Space (s.f.)	11,900	11,970	13,320	16,020

Exhibit 3F
"UNCONSTRAINED" GENERAL AVIATION
& SUPPORT FACILITY REQUIREMENTS